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Comparison of Laparoscopic vs Open Modified Shouldice Technique in Inguinal Hernia Repair

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ABSTRACT

Inguinal hernia repair has been a common procedure performed by general surgeons. Recently, a newly developed approach has been introduced using the pre-peritoneal laparoscopic repair. The laparoscopic approach allows patients to recover faster, with less pain; however, a disadvantage is the higher cost. We conducted a retrospective study of inguinal hernia repairs performed by one surgeon at the same institution, comparing the laparoscopic technique to the modified Shouldice procedure with regard to surgical time, postoperative recovery time, charge, and time to return to work and to activities. Patients undergoing laparoscopic hernia repairs were able to return to work and to activities sooner than patients undergoing the modified Shouldice procedure. The results obtained in this study showed a higher charge for the laparoscopic procedure, with longer surgical and recovery room time. The more rapid return to work and activities may outweigh the higher charge and longer surgical and recovery room time.

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INTRODUCTION

Inguinal hernia repair has been a common procedure performed by general surgeons for the past 100 years.[1] The traditional treatment has been a conventional open repair including such methods as Bassini, Shouldice, or Liechtenstein. Of all of the methods, the Shouldice repair has been one of the most scientifically evaluated methods for hernia repair and is claimed to be the gold standard for comparison with the newer techniques.[2] Recently, a new approach was introduced to repair hernias, which was the laparoscopic method. An advantage of the laparoscopic approach is that it allows patients to recover faster, with less pain.[3] However, disadvantages are the more expensive charge and longer surgical time.[2,4] The dilemma thus becomes, Is it more cost-effective to perform a more expensive procedure for a quicker return to work? We conducted a retrospective study of inguinal hernia repairs performed by one surgeon at the same institution using the laparoscopic pre-peritoneal approach and the modified Shouldice technique, comparing surgical time, postoperative recovery time, charge, and time to return to work and to activities.

METHODS

A retrospective study was performed involving patients undergoing inguinal hernia repair from January 1996 to January 1998. All the patients had elective hernia surgery performed by the same surgeon in the same institution. A total of 85 patients were evaluated, with 45 undergoing the laparoscopic repair and 40 undergoing an open modified Shouldice repair. Operative records were examined, and telephone interviews were conducted on all 85 patients. Patient selection involved males from 20 to 75 years old. Patients who had both a laparoscopic repair and open repair were included in the study. Patients with more than two recurrences of inguinal hernia repair were excluded. Patients who had multiple hernia repairs by other surgeons were also excluded.

The two methods of surgical repair performed were either a modified open Shouldice repair or a pre-peritoneal laparoscopic repair. The modified Shouldice repair involved the reduction of the hernia, ligation of hernia sac, and reconstruction of the hernia floor. The reconstruction

Table 1.
Comparison of Operating Room and Outcome Variables for all Laparoscopic versus all Open Modified Shouldice Technique in Inguinal Hernia Repair.

Operating Room Variables	Laparoscopic (n=45)	Open (n=40)	p value
	mean (sd)	mean (sd)	
Surgery Time (min.)	75.71 (22.38)	46.33 (14.89)	<.001
Recovery Room Time (min.)	137.96 (41.63)	68.88 (31.49)	<.001
Charge	$2223.47 (314.56)	$1004.83 (204.29)	<.001
Outcome Variables	mean (sd)	mean (sd)	p value
Pain Score (0-10 scale)	4.78 (2.28)	5.65 (2.73)	ns
Pain Resolution (days)	4.41 (3.90)	5.11 (4.00)	ns
Resume Activities (days)*	2.42 (2.09)	4.71 (4.96)	.01
Off Work (days)	11.58 (7.19)	22.68 (15.72)	<.001
Resume Athletic Activities (days)	19.18 (9.72)	26.09 (16.05)	<.001

*Mann Whitney test used due to skewed data.

involved a closure of the transversalis fascia with a 2-0 Proline (8411) suture in a running overlapping fashion. The conjoined tendon and free edge of Poupart's ligament were also approximated in a running fashion using O-Proline, as described by the Shouldice technique. The repair was performed with local lidocaine under monitored anesthesia.

The laparoscopic method was a pre-peritoneal technique. The procedure was performed under general anesthesia. An Origin PB2 dilator using balloon dissection was used to form the pre-peritoneal space without entering the abdominal cavity. Isolation of the spermatic cord was done, and a polypropylene mesh was placed over the myoperitoneal orifice with tackers. The mesh was keyholed for the cord structure to pass through freely. Injection of 30 cc. of 0.5% marcaine was then placed within the pre-peritoneal space prior to closing.

Data was collected in two parts. The first involved a telephone interview with the patients undergoing hernia surgery within the two-year period. Patients were asked the same questions using the same scale for evaluation. A 1 to 10 scale, with 1 being minimal and 10 being intense, was used to grade pain responses. The questions were as follows:

1) Severity of pain upon arrival home on the day of surgery.
2) Number of days until pain was gone.
3) Number of days until normal activities such as walking and climbing stairs resumed.
4) Number of days that the patient was out of work.
5) Number of days to start performing strenuous exercises including jogging, mowing lawns, or participating in athletics.

Patients were excluded if they were unable to complete the entire interview. Patients who were retired or unemployed were asked when they would have returned to work had they been working.

The second part of the study involved evaluation of the operating room record. The data collected included surgical time, recovery room time, and operation charge. The data was obtained for both laparoscopic and open hernia repairs. The surgical time was counted from time of skin incision to skin closure. The recovery room time was from exit from operating room to time of discharge. The charge included the cost for the room, anesthesia, and equipment.

The data was evaluated by comparing the results of the laparoscopic technique to the open technique. Simple and bilateral hernia repairs were included. A T-test and Mann-Whitney test were used to statistically evaluate the comparisons. Statistical difference was achieved with a p value less than 0.05 regarding the Mann-Whitney and T-test comparisons.

Table 2.
Comparison of Operating Room and Outcome Variables for Single Laparoscopic versus Single Open Modified Shouldice Technique in Inguinal Hernia Repair.

Operating Room Variables	Laparoscopic (n=14)	Open (n=28)	p value
	mean (sd)	mean (sd)	
Surgery Time (min.)	66.57 (22.22)	40.21 (11.57)	<.001
Recovery Room Time (min.)	138.64 (34.03)	67.57 (33.18)	<.001
Charge	$2190.07 (346.55)	$925.25 (111.15)	<.001
Outcome Variables	**mean (sd)**	**mean (sd)**	**p value**
Pain Score (0-10 scale)	4.86 (1.88)	5.14 (2.55)	ns
Pain Resolution (days)	3.96 (2.82)	4.57 (3.50)	ns
Resume Activities (days)*	2.43 (2.21)	4.23 (4.41)	ns
Off Work (days)	10.43 (5.69)	20.82 (15.28)	<.01
Resume Athletic Activities (days)	18.07 (8.40)	25.20 (16.24)	ns

*Mann Whitney test used due to skewed data.

RESULTS

A total of 85 patients were evaluated, with 45 patients undergoing laparoscopic repair and 40 undergoing open repair. The laparoscopic groups included 14 patients with simple hernia repair and 31 with bilateral repair. The open technique included 28 patients with single repair and 12 undergoing bilateral hernia repair.

The comparison of the laparoscopic group to the open technique group, regardless of single or bilateral repair, can be seen in **Table 1**. The surgical time is 75.71 minutes vs 46.33 minutes, recovery room time is 137.96 minutes vs 68.88 minutes, and charge is $2223.47 vs $1004.88 for laparoscopic vs open procedure, respectively. The comparison of laparoscopic vs open regarding severity of pain is 4.78 to 5.65, days until pain resolution is 4.41 to 5.11, days to resume activities is 2.42 to 4.71, days out of work is 11.58 to 22.68, and days to resume athletic activities is 19.18 to 26.09. The comparison of pain severity and resolution of pain were not statistically different.

The results comparing single laparoscopic and open single hernia repairs can be seen in **Table 2**. The surgical time is 66.57 minutes vs 40.21 minutes, recovery room time is 138.64 minutes vs 67.57 minutes, and charge is $2190.07 vs $925.25 for laparoscopic vs open procedure. The comparison of laparoscopic vs open regarding severity of pain is 4.86 to 5.14, days until pain resolution is 3.96 to 4.57, days to resume activities is 2.43 to 4.23, days out of work is 10.43 to 20.82, and days to resume athletic activities is 18.07 to 25.20. Only the comparison of days to return to work was statistically significant.

The results comparing bilateral laparoscopic and open bilateral hernia repairs can be seen in **Table 3**. The surgical time is 79.84 vs 60.58 minutes, recovery room time is 137.65 minutes vs 71.92 minutes, and charge is $2238.55 vs $1190.50 for laparoscopic vs open repair. The comparison of laparoscopic vs open regarding severity of pain is 4.74 to 6.83, days until pain resolution is 4.61 to 6.38, days to resume activities is 2.42 to 5.83, days out of work is 12.10 to 27.00, and days to resume athletic activities is 19.68 to 28.17. The comparison of pain severity and days to return to work were statistically significant.

DISCUSSION

The use of laparoscopic surgery has revolutionized general surgery. The change can be easily demonstrated by evaluating gallbladder disease.[1] Patients are now able to have a laparoscopic cholecystectomy performed in less surgical time than an open cholecystectomy. Postoperatively, laparoscopic patients have a shorter recovery time with less pain and are able to return to work and activities sooner than patients undergoing the open techniques. The great success seen with gallbladder surgery can also be applied to hernia surgery. The laparoscopic hernia repair has now become a possible alternative to the traditional open technique. The dilemma is that

Table 3.
Comparison of Operating Room and Outcome Variables for Bilateral Laparoscopic versus Bilateral Open Modified Shouldice Technique in Inguinal Hernia Repair.

Operating Room Variables	Laparoscopic (n=31)	Open (n=12)	p value
	mean (sd)	mean (sd)	
Surgery Time (min.)	79.84 (21.53)	60.58 (11.86)	.006
Recovery Room Time (min.)	137.65 (45.16)	71.92 (28.26)	<.001
Charge	$2238.55 (303.85)	$1190.50 (252.81)	<.001
Outcome Variables	**mean (sd)**	**mean (sd)**	**p value**
Pain Score (0-10 scale)	4.74 (2.46)	6.83 (2.89)	.02
Pain Resolution (days)	4.61 (4.33)	6.38 (4.91)	ns
Resume Activities (days)*	2.42 (2.07)	5.83 (6.12)	ns
Off Work (days)	12.10 (7.80)	27.00 (16.56)	.01
Resume Athletic Activities (days)	19.68 (10.36)	28.17 (16.08)	.046

*Mann Whitney test used due to skewed data

the laparoscopic method allows patients to have less pain,[5] and return to work and activities sooner,[4,6] but this is achieved with a longer surgical time and a higher charge. Therefore, the cost-effectiveness of this procedure needs to be evaluated.[2]

The results of our study comparing overall laparoscopic repair to the open technique indicated that the laparoscopic repair had a longer surgical time by 29.38 minutes, longer recovery room time by 69.08 minutes, and a higher charge by $1218.59, than the open technique. The explanation of these differences can be attributed to several factors. The laparoscopic pre-peritoneal approach requires general anesthesia, causing longer operating room time, whereas the open technique can be performed under local anesthesia. The longer surgical time for the laparoscopic procedure is caused by the additional time needed to enter and dissect the pre-peritoneal space with the balloon. This fact is supported when comparing the time for the laparoscopic single repair (66.57 minutes) with the laparoscopic bilateral repair (79.84 minutes). The average time to perform the second hernia repair in the bilateral patient is 13.27 minutes since the pre-peritoneal space is already dissected. This is compared to the single vs bilateral open technique when the additional time to complete the second repair is 20.37 minutes. The longer surgical time can be related to the novelty of the pre-peritoneal procedure. The length of time for our surgical laparoscopic procedures included early experience for the surgeon and staff. Our early operative experience included cases with associated indirect hernias, which required more extensive dissection and, thus, longer surgical times. The learning curve with this laparoscopic procedure resulted in longer times initially, which have noticeably decreased with experience.

Patients undergoing laparoscopic procedures receive general anesthesia, and, therefore, recovery room time is considerably longer. These patients require more observation and have more side effects such as confusion and nausea. The open technique procedure patients receive local anesthesia and are, thus, able to be discharged sooner since they do not have the systemic effects of general anesthesia. Concern for the longer recovery room time has introduced the use of epidural anesthesia as a possible alternative to reduce this time factor.

A significant difference is also seen when comparing charges for the two procedures. There are several explanations for the average $1000 to $1264 more expensive cost for the laparoscopic procedure. First, the charge for a laparoscopic operating room is $2-$5 per minute more expensive than a general surgery room. Second, the laparoscopic kit required ranges from $400 to $600. This kit includes the dissector and trocars. Third, the cost for general anesthesia is greater than for local anesthesia.

The second part of the study involves the postoperative follow-up including the pain severity, pain duration, days

to resume activities, and days to return to work. Comparing the overall results of pain severity and duration did not indicate a statistically significant difference. However, the results indicate a trend that the laparoscopic repair did appear to have less pain, which resolved quicker. This difference is supported when evaluating the pain severity in patients undergoing bilateral hernia repair. These patients had statistically significantly less pain than the open technique. This difference can possibly be attributed to less dissection and smaller incision in the laparoscopic repair. Additionally, the Shouldice procedure involves sutures placed under tension as well as requiring dissection through tissue planes along with tissue retraction. The laparoscopic procedure has minimal dissection with placement of a mesh support without tension.

Patients undergoing laparoscopic repair were able to return to activities, resume athletic activities, and return to work sooner than the open repairs. This was statistically significant and may be attributed to several reasons. When laparoscopic surgery initially began with gallbladder disease, the main advantage was less pain, shorter hospital stays, and quicker return to work. The success of the laparoscopic cholecystectomy can be applied to laparoscopic hernia repair. Patients understand that the laparoscopic method is designed for less pain and are, thus, prepared to expect to return to activities and to work sooner. Psychologically, the laparoscopic patient expects to recover faster. Second, patients have surgical repair done without tension or a large surgical incision. Patients are also encouraged to walk sooner because there is no tension along the suture lines or tissue planes. Thus, the fear of breaking a suture is removed. Less pain keeps patients from being discouraged from walking or returning to work.

An advantage of laparoscopic repair is the quicker return to work. However, this is achieved with a longer surgical procedure time, longer recovery room time, and greater charge. In the present health care crisis, where cost effectiveness is carefully evaluated, the more costly laparoscopic procedure can be considered cost-efficient. For example, in March 1997, the U.S. Department of Labor, Bureau of Labor Statistics reported that employer costs for employee compensation for civilian workers, in private industry and state and local government, in the United States averaged $19.22 per hour worked. Thus, if a person misses 11-15 days of work at 8 hours per day, the cost to the employer may be as much as $1760 to $2310. Since the laparoscopic procedure costs on average $1000 to $1200 more, the savings per person could range from $500 to $1400.

CONCLUSION

Patients in this study undergoing laparoscopic hernia repairs were able to return to work sooner and resume activities and more strenuous athletic activities faster than patients undergoing the traditional open modified Shouldice technique. The results obtained in this study showed a higher charge for the laparoscopic procedure with longer surgical and recovery room time. The more rapid return to work and to activities may outweigh the higher charge and longer surgical and recovery room time.

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